AMENDED SPECIFICATION

Reprinted as amended in accordance with the Decision of the Superintending Examiner, acting for the Comptroller-General, dated the twenty-fourth day of January, 1940, under Section 11 of the Patents and Designs Acts, 1907 to 1939.

PATENT SPECIFICATION

509,004

Application Date: Jan. 24, 1938. No. 4991/39.

(Divided out of No. 508,980).

Complete Specification Left: Aug. 8, 1938.

Complete Specification Accepted: July 10, 1939.

PROVISIONAL SPECIFICATION

Improvements in or relating to Cages for use in Roller Bearings

We, RANSOME & MARLES BEARING COMPANY LIMITED, a Company incorporated according to British Law, of Stanley Works, Newark-on-Trent, and FREDERICK OSGOOD HICKLING, British Subject, of "Charnwood," 56, Davies Road, West Bridgford, Nottingham, both in the County of Nottingham, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in cages for use in roller bearings and particularly to improvements in the manufacture of one piece cages, the construction being such that a more efficient cage can be provided at a cheaper cost.

In cages of the two piece type which are riveted together, the amount of raw material used to produce the cage is excessive, and it has been found difficult to make a cage in two or more pieces dead concentric one piece with the other and otherwise efficient owing to the necessary drilling and rivetting. It is the object of this invention to so construct the cage in one piece that it will be of lighter construction, have longer life and be less costly to manufacture.

A further object is to provide a one piece cage of economical manufacture which will require no rivetting or spigotting, the arrangement being such that lubrication can be more readily effected thereby increasing the life of the cage and allowing of much higher speeds.

With these and other objects in view the invention consists in providing a cage of substantially bridge formation, the said cage having a series of spacing bars integrally connected at each end to upper or lower ring-like members so that a roller or rollers can be placed and held within each of the apertures formed by the said spacing bars and the connecting rings.

The invention further consists in forming a cage from a sleeve of substantially **U** shape in longitudinal section, the apertures for the rollers being formed by slotting the said sleeve at intervals thereby leaving longitudinally arranged spacing bars connected at their ends to rings members, the said ring members being formed by the inwardly or outwardly provided flanges of the said **U**-shaped sleeve, the said sleeve being of either cylindrical or conical formation so that either cylindrical or tapered conical rollers may be used in the said cage. If desired, means may be provided to retain the rollers in the said cage.

According to one form of this invention and when applied to a cylindrical cage adapted to carry cylindrical rollers, the said cage which is of bridge or squirrel cage formation is produced from either a bar or tube and the manufacture of such a cage consists of only two major operations. The first consists in turning the outer diameter and the bore and a recess so as to provide a sleeve of substantially **U**-shape in longitudinal section, that is to say, the sleeve will have an inward flange at each end of substantially square or rectangular shape in cross section. When this operation is completed this sleeve is parted off and the outer diameter of the sleeve is longitudinally slotted at intervals in any convenient manner so as to leave a series of spacing bars conveniently of substantially **V** or tapered shape in cross section. Thus it will be seen that the spaces between the spacing bars will provide square or rectangular shaped holes in which the rollers of the bearings are adapted to be fitted. The cage may be of any convenient length as to permit of the insertion of one or more rollers in each hole, the said roller or rollers being

[*Price* 1/-]

guided at each end by the inwardly arranged rings.

In the above construction, a bridge-like cage is provided and the supporting rings are arranged inwardly at each end of the cage, but obviously these rings may be arranged outwardly at each end of the cage by forming the flanges on the outer diameter of the sleeve. The slots may be produced either by milling, hobbing or slotting or broaching, in the case of the type of cage in which the slots are in the bore instead of in the outer diameter. It will be understood that the spacing bars will extend the full length of the cage and that the slots between the bars for taking the rollers will also extend the full length of the cage. Thus in end elevation the cage will be in the form of a ring having either outwardly or inwardly radially arranged projections formed by the ends of the spacing bars. When the projections extend radially outwardly, the cage will be constructed as first described, but when the projections extend inwardly of the rings the cage will be according to the latter construction. The spacing bars or ribs would obviously be slightly tapered in cross section so as to permit of the carrying of cylindrical rollers. It will be seen that such a construction will be much lighter and stronger than the riveted type of cage and that the supporting diameters of the cage will be dead concentric one with the other, a condition which rarely applies in the case of a cage of the two piece riveted type. The design is also such as to definitely ensure that the roller holes are dead parallel.

In the above description cylindrical cages have been described, but obviously the cages may be of conical construction and formed to take either cylindrical rollers or tapered conical rollers. The cage may be made of any suitable and usual material and the construction is such that the cage may be employed in connection with multi-row roller bearings. It will be understood that cages above described could be made to carry a greater number of rollers than is possible with cages constructed of two or more pieces riveted together since the spacing bars can be of the minimum cross sectional area. Heretofore, it has been a lengthy operation to drill the roller holes in a cage, and it has also been found extremely difficult to ensure dead squareness with the axis. As the cage is of one piece construction, the amount of raw material required is considerably less than that required to produce the usual two piece riveted type of cage. Any of the usual means may be provided to retain the rollers within the cage but preferably means such as described in our prior Letters Patent No. 410,891 dated the 14th day of December 1932, are employed. In this case a groove or grooves would be rolled on the cage so as to extrude projections to retain the rollers.

Cages constructed according to this invention can be more readily lubricated as they are of squirrel cage form, and it is obvious that the lubricant is more readily obtained on the portion of the cage and bearings where vitally necessary. Thus the life of the cage is increased and much higher speeds may be permitted.

It will also be seen that the capacity of a bearing can be greatly increased by the employment of cages above described as a greater number of rollers can be arranged around the circumference owing to the spacing bars having the minimum amount of metal and multiple rows of rollers up to any number can be more readily accommodated than is possible with drilled or riveted cages.

Dated this 15th day of February, 1939.
WITHERS & SPOONER,
Chartered Patent Agents,
148—150, Holborn, London, E.C.1,
Agents for the Applicant.

COMPLETE SPECIFICATION

Improvements in or relating to Cages for use in Roller Bearings

We, RANSOME & MARLES BEARING COMPANY LIMITED, a Company incorporated according to British Law, of Stanley Works, Newark-on-Trent, and FREDERICK OSGOOD HICKLING, British Subject, of "Charnwood", 56, Davies Road, West Bridgford, Nottingham, both in the County of Nottingham, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in cages for use in roller bearings and more particularly but not necessarily to improvements in the manufacture of one piece cages, the construction being such that a more efficient cage can be provided at a cheaper cost.

In cages for ball bearings it has previously been proposed to form a cage of two U-shaped pressed metal rings, the

backs of which are turned towards each other and stamped out to form openings for the reception of the balls.

In roller bearings it has also been proposed to provide a conical cage for taper rollers consisting of two rings of different diameter with their outer edges rigidly connected by arms positioned between each of the rollers, the rollers being retained against axial movement by circumferential flanges or projections formed on the bearing surface. It is the object of this invention to so construct the cage for thrust roller bearings preferably in one piece that it will be of lighter construction, have longer life and be less costly to manufacture.

A further object is to provide a cage of economical manufacture which will require no riveting or spigotting, the arrangement being such that lubrication can be more readily effected thereby increasing the life of the cage and allowing of much higher speeds.

With these and other objects in view the invention consists in the method of forming a cage for thrust roller bearings from an annulus of material of substantially **U**-shape in cross section, the material between the flanges of the **U**-shaped annulus being cut away at intervals so as to leave a series of radially arranged spacing bars connected at their ends by concentric ring-like members thus providing slots for the reception of rollers, the said slots being produced either by a milling or hobbing or slotting or broaching operation. The slots are radially arranged in the annulus so as to provide spacing bars in a plane parallel to but spaced from a plane containing the concentrically arranged rings formed by the flanges of the **U**-shaped annulus. The slots may be of equal width throughout for the reception of cylindrical rollers or of tapered formation for the reception of tapered conical rollers. If desired, means may be provided to retain the rollers in the said cage.

The invention still further consists in providing a cage from an annulus of material of **U**-shape in cross section, the material between the flanges of the **U**-shaped cross section being cut away radially at intervals so as to leave a series of spacing bars thereby providing slots for the reception of rollers between the said spacing bars and concentrically arranged rings connected therewith.

The invention still further consists in forming a cage from a pair of the above described members, the rings of the said members being connected together so as to retain the rollers in the said cage, the said rings being connected together by welding or by a clamping ring or rings.

The invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a cross section of one form of cage constructed according to this invention, suitable for a roller thrust bearing and made from a bar, tube or forging.

Figure 2 is a part plan thereof.

Figure 3 is a part perspective view thereof.

Figure 4 is a similar view to Figure 1 showing part of a cage made from a pressing.

Figure 5 is a part sectional view of a modified form of cage made from a pressing.

Figure 6 is a part cross section of a cage for a taper roller thrust bearing, the bearing rings and rollers being shown by dotted lines.

Figure 7 is a part plan thereof.

Figure 8 is a part sectional view of two parts of a cage for a roller thrust bearing, and

Figure 9 is a similar view showing the two halves of the cage welded together and adapted to retain the rollers.

Figure 10 is a part sectional elevation thereof in diagram drawn to an enlarged scale showing the method of retaining a roller in position.

Figure 11 is a part sectional elevation similar to Figure 9 showing a modified method of holding a two part cage adapted to retain the rollers.

Figure 12 is a similar view to Figure 11 showing a cage adapted to hold two sets of rollers.

Figure 13 is a part plan thereof.

Figure 14 is a similar view to Figure 12 showing a further modified method of connecting the two parts of a cage together, the said cage adapted to hold two sets of rollers.

Figure 15 is a part plan thereof.

Figure 16 is a part sectional elevation of a pair of two part cages adapted to hold a multiplicity of rollers, and

Figure 17 is a part plan thereof.

According to one form of this invention and when applied to a cage adapted to carry cylindrical rollers 2, the said cage which is of bridge formation as shown in Figures 1 to 2 is produced from either a bar or tube and the method of manufacture of such a cage consists of only two major operations. The first consists in turning the outer diameter 3 and the bore and a groove or recess 4 and when this operation is completed the annulus is parted off. Thus there is provided an annulus of substantially **U**-shape in cross section as shown in Figure 1, the annulus having on one face the

annular groove or recess 4 between concentric flanges 5 of substantially square or rectangular shape in cross section. The other or plain face of the annulus is then radially slotted at intervals in any convenient manner such as by a milling cutter so as to leave a series of spacing bars 7 of substantially V or tapered shape. The spaces 8 between the spacing bars 7 will provide square or rectangular shaped holes 8 in which the rollers 2 of the bearing are adapted to be fitted. The cage may be of any convenient size as to permit of the insertion of one or more rollers 2 in each hole or space 8, the said roller or rollers 2 being guided at each end by rings 9 formed by the flanges 5. It will be seen that the spacing bars 7 will thus be integrally connected at each end to concentric rings 9 and that these rings 9 will be arranged in a plane parallel with and spaced from the plane containing the spacing bars 7. The spacing bars 7 and slots 8 therebetween will extend the full width of the annular cage so as to provide slots between the rings 9 for taking the rollers 2. Thus the cage will be in the form of a pair of spaced rings 9 carrying a plurality of V-shaped spacing bars 7 projecting upwardly from the said rings 9. The slots 8 may be formed either by milling, hobbing, slotting or broaching, the material of reduced thickness between the flanges 5 being radially cut away at intervals to provide the connected spacing bars 7.

Figure 4 shows a substantially similar cage to that previously described but constructed from a pressing of an annular U-shape, the material being pressed to provide a pair of concentric flanges 11 connected by a substantially flat annular face 12, the latter being so milled as to provide the spacing bars 7 integrally connected at each end to the concentric rings 9.

In a further modification as shown in Figure 5, the annulus is of pressed metal as in the previous construction but the flat face is dished or curved as shown at 13 so as to provide spacing bars 7 of curved or corrugated shape in longitudinal section connected at each end by the concentric rings 9. Such a construction will obviously permit of ready lubrication.

Figures 6 and 7 show a similar type of cage to that described and shown with reference to Figures 1 to 3 but the slots 8 therein are so cut or shaped as to provide slots 8 for the reception of taper or conical rollers 10. The cage will thus be particularly suitable for use in a taper roller thrust bearing. In this case the spacing bars 7 connecting the inner and outer rings 9 are of less taper throughout their length than in the case where cylindrical rollers are used. This form of cage may obviously be made from a bar or tube or from forgings or pressings.

In the above constructions any suitable means may be provided to retain the rollers within the cage and means such as described in our prior Letters Patent No. 410,891 dated the 14th December 1932, may be employed. For instance, a groove or grooves may be rolled on the cage so as to extrude projections to retain the rollers. Alternatively the cage may be made in two halves connected together so as to retain the rollers within the cage.

Figure 8 shows a pair of annular members each being similar to that shown in Figures 1, 2 and 3, but of less thickness. The ring portions 9 of these two members may be connected together in any suitable manner by any convenient form of fastening means so as to secure the rollers therein. Figure 9 shows these rings 9 connected together by welding at 14 the contacting circumferential edges of the rings 9 so that the rollers 2 will be retained in the cage by the oppositely arranged spacing bars 7 as shown more particularly in Figure 10. This form of cage may be made from either a bar, tube or from forgings or pressings.

Figure 11 shows a further modified form of single roller retaining cage made in two halves from a bar, tube, forgings or pressings as in the previous construction but held together by a metal band 15. This band 15 is pressed over at intervals between the spacing bars and into the roller slots as shown at 16, the inwardly pressed portions 16 of the band 15 thereby connecting the rings 9 together so that the spacing bars 7 retain the rollers 2 in the two part cage.

Figures 12 and 13 show a similar type of cage to that shown in Figure 11, the cage being of multi-roller type adapted to hold two concentric rows of rollers.

In a still further modified construction as shown in Figures 14 and 15 the cage is again made in two halves from, for instance, a bar or a tube or from forgings or pressings, the two parts of the cage being held together by means of a metal band 17 rolled over flanges 18 formed on the outer diameter of the outer ring. This metal band 17 is pressed over the flanges 18 to form a ring of substantially U-shape in cross section. This metal band 17 is shown on the outer diameter of the annular cage, but obviously a similar band of smaller diameter may be arranged on the flanges inner diameter of

the cage to further connect the two parts of the cage together.

Where an even greater multiplicity of rollers is desired, the cages may be arranged one within the other to carry a single or multiple arrangement of rollers. Figures 16 and 17 show such an arrangement applied to cages constructed according to that shown in Figures 12 and 13, and it will be seen that a smaller cage is arranged within a larger cage and the respective cages are independent of each other so as to permit of automatic slip one in relation to the other.

We are aware of Specification No. 444,292 which describes and claims a roller thrust bearing having a cage composed of two spaced annular-like plates each radially slotted to receive one or more rows of rollers, in which one or both plates have flanges or bent portions which permit the plates to be directly connected one to the other. We do not claim anything therein described or claimed.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of forming cages for use in roller bearings consisting in forming an annulus of material of substantially **U** shape in cross section, the material between the flanges of the **U** shaped annulus being cut away at intervals so as to leave a series of radially arranged spacing bars connected at their ends by concentric ring-like members, thus providing slots for the reception of rollers, the said slots being produced either by a milling or hobbing or slotting or broaching operation.

2. A method of constructing a cage for roller thrust bearings consisting in first providing an annulus of **U** shape in cross section then radially slotting the face of the annulus so as to provide spacing bars and apertures for the reception of rollers, the said spacing bars being thus arranged in a plane parallel to and spaced from a plane containing the concentrically arranged rings.

3. A method of constructing a cage for roller thrust bearings as claimed in claim 2, wherein the slots are of equal width throughout for the reception of cylindrical rollers or of tapered formation for the reception of conical rollers.

4. A method of constructing a cage for roller thrust bearings as claimed in claim 2, wherein the **U** shaped annulus is cut from a bar or tube or formed from a forging or pressing.

5. A cage for use in roller thrust bearings comprising radially arranged spacing bars integrally connected at each end to concentric ring-like members to provide slots for the reception of radially disposed rollers adapted to be positioned between the rings, the spacing bars being arranged in a plane parallel to and spaced from a plane containing the rings.

6. A cage for use in roller thrust bearings as claimed in claim 5, wherein the spacing bars are of **V** or tapered shape to provide square or rectangular shaped holes between the rings and the spacing bars for the reception of cylindrical rollers or shaped to provide conical shaped holes for the reception of tapered conical rollers.

7. A cage for use in roller thrust bearings as claimed in claims 5 or 6, wherein the spacing bars are of curved or corrugated form throughout their length.

8. A cage for use in roller thrust bearings wherein the cage comprises a pair of members as claimed in claim 5, the pair of members being connected together to provide a cage for retaining the rollers by oppositely arranged spacing bars.

9. A cage for use in roller thrust bearings as claimed in claim 8, wherein one or both oppositely arranged pairs or rings of the pair of members are welded together.

10. A cage for use in roller thrust bearings as claimed in claim 8, wherein one or both of the oppositely disposed rings of the members are connected together by a circumferential band pressed over at intervals between the spacing bars for the purposes described.

11. A cage for use in roller thrust bearings as claimed in claim 8, wherein the rings of the pair of members are formed with flanges connected together by a circumferential ring or rings bent to substantially **U** shape in cross section.

12. A cage for roller thrust bearings comprising two or more annular cages as claimed in claims 5 or 8, the diameters of the cages being such that they may be arranged concentrically within each other and adapted to rotate independently of each other.

13. An improved method of constructing cages for use in roller thrust bearings substantially as described.

14. An improved roller thrust bearing constructed substantially as described with reference to Figures 1 to 3 or to Figure 4 or to Figure 5 or to Figures 6 and 7 or to Figures 8 to 10 or to Figure 11 or to Figure 12 or to Figures 13 to 15 or to Figures 16 and 17 of the accompanying drawings.

Dated this 15th day of February, 1939.

WITHERS & SPOONER,
Chartered Patent Agents,
148—150, Holborn, London, E.C.1,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.

Fig. 1.

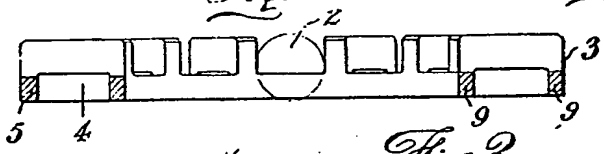


Fig. 2.

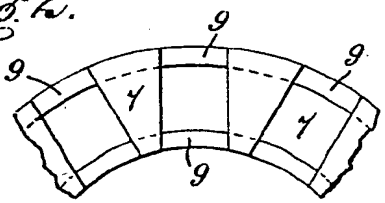


Fig. 3.

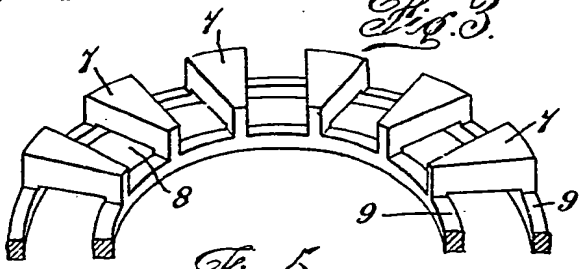


Fig. 4.

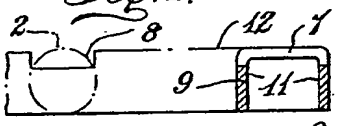


Fig. 5.

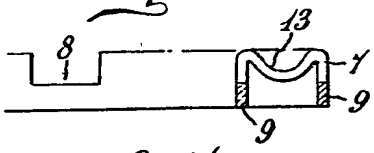


Fig. 6.

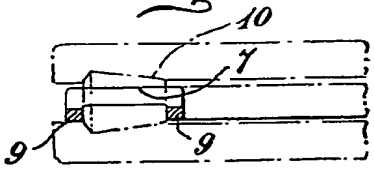


Fig. 7.

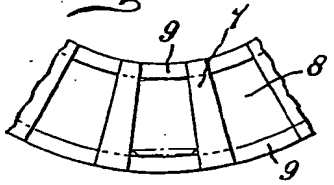


Fig. 8.

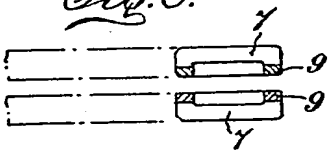


Fig. 9.

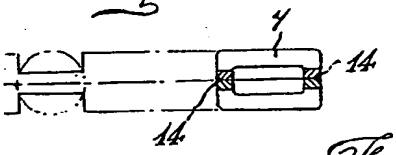


Fig. 10.

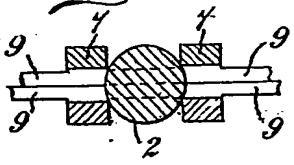


Fig. 11.

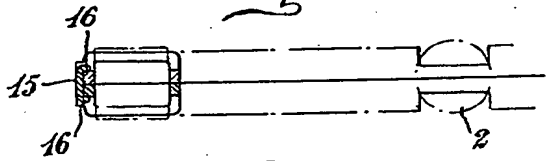
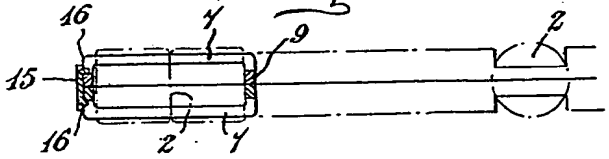
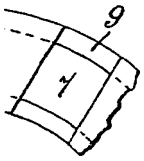
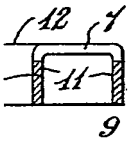
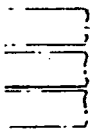


Fig. 12.









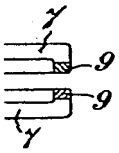


Fig. 13.

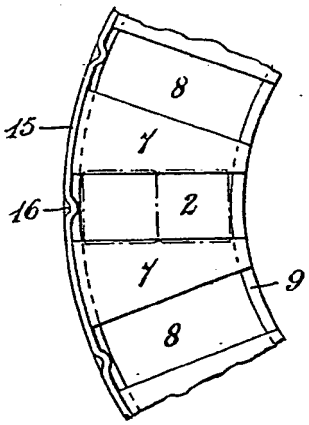
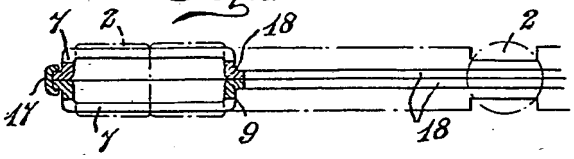


Fig. 14.



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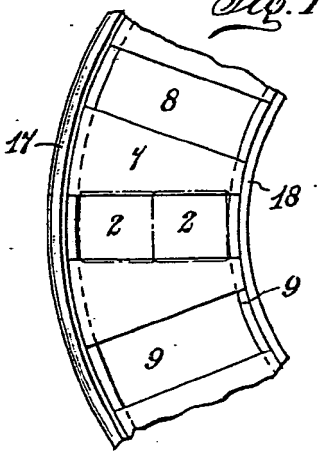


Fig. 16.

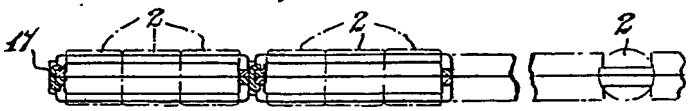
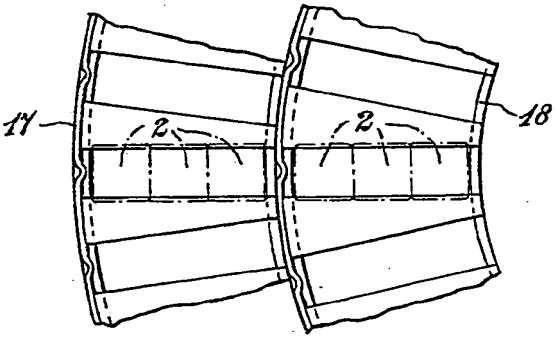
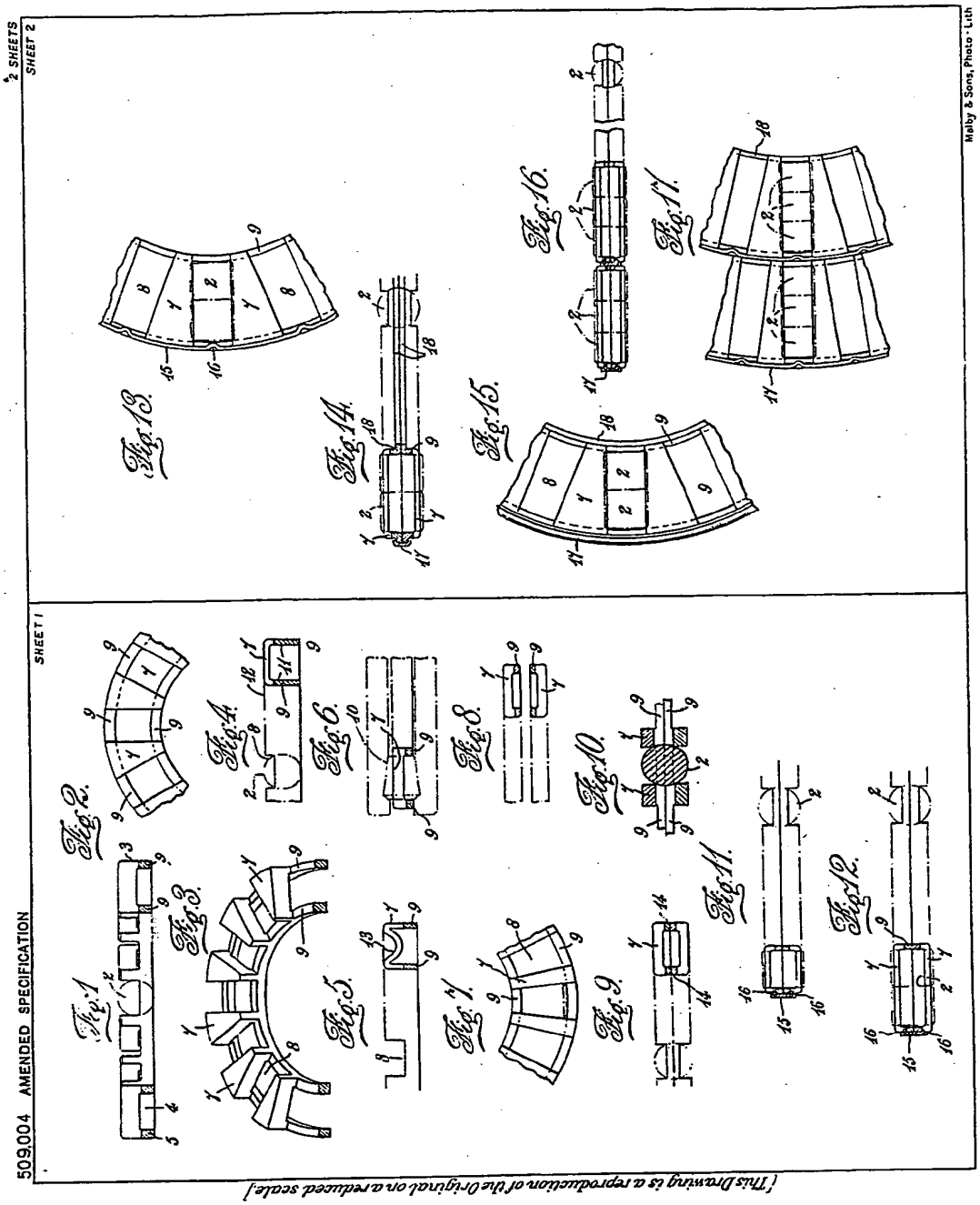


Fig. 17.



Malby & Sons, Photo-Lith.



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